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CONTENTS

Scientific Research Interpreted 390

Interpretation of Data Obtained with Spectrophotometers of the Polarizing Type. Robert D. Nutting 391

Silk Fibroin Dispergation. Mearl A. Kise 401

Dr. Katz Lectures on Starches 415

Abstracts 416

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Scientific Research Interpreted

THE symposium on the importance and need of interpretation of scientific research, that was the feature of the speaking program of U. S. Institute's last annual meeting, has already been resultful.

The Textile Foundation is considering ways and means by which the results of its researches, as originally reported by its fellows in the language of the scientist, may be translated into language that may be understood by the technician.

The American Association of Textile Chemists and Colorists has actually started an interpretative program. In the *American Dyestuff Reporter* of May 6 was published an interpretative review of Parts IV and V of A. A. T. C. C.'s Wool Carbonizing Project, by Roland E. Derby, chairman of the subcommittee in charge of this study by R. A. Ryberg, and in the June 3 issue of this official publication of the Association appeared an interpretative review, by Alban Eavenson, chairman of the sub-committee on the Chemistry of Wool, of the work done on this study during 1934 by Milton Harris, research associate of the A. A. T. C. C. Both of these reviews are excellent examples of what can be done to interpret abstruse scientific findings in language that should be clear to any capable technician.

In organizing its research on warp sizing U. S. Institute provided in advance for the interpretation of results in as non-scientific language as possible by the appointment of an Advisory Committee made up of men having both scientific and technical knowledge of the subject. This committee, with the Administration Committee and the research directors, will be responsible for the preparation of an interpretative review of results of the research.

While research results thus interpreted to the technicians of the industry should go far toward stimulating their practical application, and thus provide textile executives with the additional demonstrations of their value that are essential to ensure continued financial support of research, the executive will do well to profit by the following suggestion of Dr. Robert E. Rose

Continued on page 400

Interpretation of Data Obtained with Spectrophotometers of the Polarizing Type

By ROBERT D. NUTTING *

Summary

Many spectrophotometers utilize polarizing prisms and determine the reflection factor of the sample by plane polarized light. In general, the reflection factor of the sample is independent of the azimuth of the plane of polarization but there are some materials, notably textiles, for which the reflection factor depends upon the azimuth. It can be shown mathematically that, if the reflection factor is determined for two azimuths at right angles to one another, the arithmetic average of the two values is the reflection factor for ordinary, or unpolarized light. This is true regardless of the azimuths selected. Experimental data are presented which indicate the applicability of this principle to the measurement of the color of textile fabrics.

Introduction

THE necessity of specifying a color by some physical means has long been realized by dyers. The difficulty of describing a color adequately in words has always been a stumbling block in the orderly solution of many of the dyer's problems. The designation of a tolerance, for example, is almost impossible if only words are used to describe the limits of this tolerance.

The fundamental method of color analysis by which a color is resolved into its elementary spectral components is known as spectrophotometry. Instruments used in making such an analysis are called spectrophotometers. Such instruments measure the proportion of the incident light that is reflected from (or transmitted by) the specimen at each wavelength of the visible spectrum. The results of such an analysis are conveniently represented by a chart on which the reflection factor (or transmission factor) is plotted against the wavelength of the light. Several such charts are presented in this paper.

In some spectrophotometers, light from a convenient source such as a tungsten lamp is dispersed into a spectrum by means of a prism. A narrow portion of the spectrum is then selected and is directed onto the sample and also onto a white standard (usually magnesium oxide). The intensity

* Dr. Nutting is a Senior Fellow of the Textile Foundation working under the direction of Prof. Arthur C. Hardy, Dept. of Physics, Massachusetts Institute of Technology, Cambridge, Mass.

of the light reflected from the sample relative to that reflected from the standard is the reflection factor of the sample at the wavelength selected. This quantity is usually evaluated by means of a combination of polarizing prisms. The instrument used to obtain the results presented in this paper was developed by Prof. A. C. Hardy and has been described briefly in a previous communication.[1] In this instrument the sample is illuminated normally by a beam of plane-polarized light, and the light reflected by the sample is collected by an integrating sphere. In some types of spectrophotometers the sample is illuminated diffusely and viewed normally, but this is an equivalent procedure.

The eye ordinarily evaluates color under natural or unpolarized illumination, whereas spectrophotometers almost invariably use plane-polarized light. It has been observed by McNicholas[2] that, even when the photometer system lacks polarizing elements, the dispersing prism alone produces a certain amount of polarization. This difference between instrumental and visual observations is of no consequence in the large majority of cases, because most samples have no polarization effect on the light incident upon them. In other words, their reflection factors are independent of the azimuth of the plane of polarization. This paper deals with the exceptional cases that are relatively common among textile samples (all of the common textile fibres are bi-refringent) and provides a simple method for translating data obtained with plane-polarized light to a basis of ordinary illumination.

In carrying out a program of research on the spectrophotometric characteristics of dyestuffs and dyed textiles at the Massachusetts Institute of Technology,[1] fabrics which exhibit marked polarization have occasionally been encountered. One method of obtaining the reflection factors for natural light with a polarizing instrument is to rotate the sample rapidly during its examination. A rotating sample holder has been described recently by Appel,[3] who used a visual spectrophotometer with a polarizing eyepiece, and by Shelton and Emerson[4] in conjunction with an earlier non-polarizing type of the Hardy[5] instrument. These investigators rotated their samples to eliminate the surface effects of weave, twist, and nature of warp and filling. These effects are very largely eliminated by the use of an integrating sphere. However, since it is not always convenient to rotate the sample, it was thought advisable to devise a method whereby readings made with plane-polarized light might be reduced to a basis of unpolarized illumination.

It will presently be shown that, theoretically, the arithmetic average of two measurements made with plane-polarized, normally incident beams having azimuths 90° apart is equal to the value for ordinary unpolarized light. Plane-polarized light normally incident on the sample may be conveniently represented by Fig. 1. Here the sample lies in the plane of the paper and the direction of polarization for light falling perpendicularly upon it may be represented by the arrow. Ordinary unpolarized light, which may be considered as light polarized in all azimuths simultaneously, may be partially represented by the diagram in Fig. 2.

Experimental Data

To illustrate how misleading the results of a spectrophotometric analysis may be if the effect of polarization is not considered, refer to Fig. 3. This figure shows two spectral reflection curves for a single layer of parallel

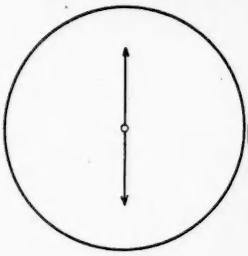

FIG. 1

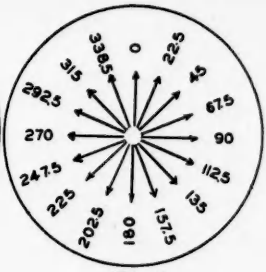

FIG. 2

threads of green silk, wound 80 to the inch and measured at two positions 90° apart in azimuth. It is, of course, advantageous to know when a sample is polarizing and to have a convenient means of measuring the magnitude of this effect. However, we are now concerned with deriving the spectral reflection curve for unpolarized light, which, as just stated, can be obtained by averaging the values from Fig. 3, since these observations

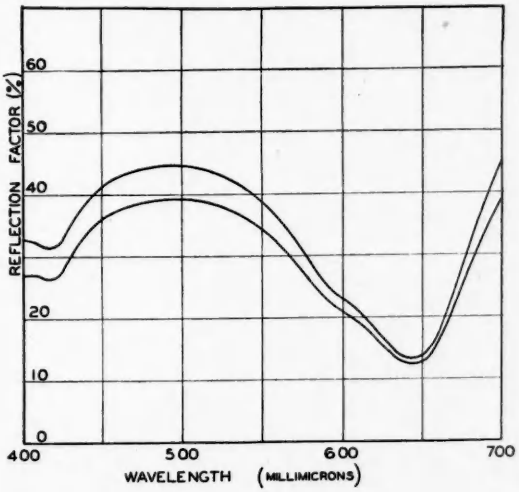

FIG. 3

were made at azimuths 90° apart. In order to study this effect in more detail, this sample was examined in eight positions, each position being spaced 45° from any other, and the reflection factors for each pair of measurements spaced 90° apart were averaged arithmetically. These data are presented for five arbitrarily selected wavelengths in Tables 1 through 5.

TABLE 1

Wavelength = 420 μ

Azimuth (Degrees)	Reflection Factor (% R)	Deviation from Mean % R	Pairs (Degrees)	Ave. % R of Pairs	Deviation of Pairs from Mean % R
0	28.2	1.05	0 & 90	29.00	0.25
45	32.3	3.05	45 & 135	29.80	0.55
90	29.8	0.55	90 & 180	29.15	0.10
135	27.3	2.05	135 & 225	29.65	0.40
180	28.5	0.75	180 & 270	28.90	0.35
225	32.0	2.75	225 & 315	29.40	0.15
270	29.3	0.05	270 & 0	28.75	0.50
315	26.8	2.45	315 & 45	29.55	0.30
Mean =	29.25	1.59			0.33
Maximum =		3.05			0.55

TABLE 2

Wavelength = 500 μ

Azimuth (Degrees)	Reflection Factor (% R)	Deviation from Mean % R	Pairs (Degrees)	Ave. % R of Pairs	Deviation of Pairs from Mean % R
0	39.8	1.24	0 & 90	40.70	0.34
45	44.4	3.36	45 & 135	41.60	0.56
90	41.6	0.56	90 & 180	40.85	0.19
135	38.8	2.24	135 & 225	41.40	0.36
180	40.1	0.94	180 & 270	40.65	0.39
225	44.0	2.96	225 & 315	41.20	0.16
270	41.2	0.16	270 & 0	40.50	0.54
315	38.4	2.64	315 & 45	41.40	0.36
Mean =	41.04	1.76			0.36
Maximum =		3.36			0.56

TABLE 3

Wavelength = 600 μ

Azimuth (Degrees)	Reflection Factor (% R)	Deviation from Mean % R	Pairs (Degrees)	Ave. % R of Pairs	Deviation of Pairs from Mean % R
0	20.0	0.98	0 & 90	20.80	0.18
45	22.3	1.32	45 & 135	21.30	0.32
90	21.6	0.62	90 & 180	20.90	0.08
135	20.3	0.68	135 & 225	21.20	0.22
180	20.2	0.78	180 & 270	20.75	0.23
225	22.1	1.12	225 & 315	21.05	0.07
270	21.3	0.32	270 & 0	20.65	0.33
315	20.0	0.98	315 & 45	21.15	0.17
Mean =	20.98	0.79			0.20
Maximum =		1.32			0.33

TABLE 4

Wavelength = 650 μ

Azimuth (Degrees)	Reflection Factor (% R)	Deviation from Mean % R	Pairs (Degrees)	Ave. % R of Pairs	Deviation of Pairs from Mean % R
0	12.7	0.53	0 & 90	13.10	0.13
45	13.9	0.67	45 & 135	13.40	0.17
90	13.5	0.27	90 & 180	13.10	0.13
135	12.9	0.33	135 & 225	13.35	0.12
180	12.7	0.53	180 & 270	13.10	0.13
225	13.8	0.57	225 & 315	13.30	0.07
270	13.5	0.27	270 & 0	13.10	0.13
315	12.8	0.43	315 & 45	13.35	0.12
Mean =	13.23	0.45			0.13
Maximum =		0.67			0.17

TABLE 5

Wavelength = 690 μ

Azimuth (Degrees)	Reflection Factor (% R)	Deviation from Mean % R	Pairs (Degrees)	Ave. % R of Pairs	Deviation of Pairs from Mean % R
0	35.8	1.19	0 & 90	36.55	0.44
45	40.3	3.31	45 & 135	37.55	0.56
90	37.3	0.31	90 & 180	36.70	0.29
135	34.8	2.19	135 & 225	37.45	0.46
180	36.1	0.89	180 & 270	36.60	0.39
225	40.1	3.11	225 & 315	37.25	0.26
270	37.1	0.11	270 & 0	36.45	0.54
315	34.4	2.59	315 & 45	37.35	0.36
Mean =	36.99	1.71			0.41
Maximum =		3.31			0.56

Since normal unpolarized light is equivalent to light polarized in all possible azimuths at once, the reflection factor of this sample at any wavelength for unpolarized light is the mean of all the readings taken. This value is given in the tables and the deviations from this mean value are shown to be as high as 6% (where the reflection factor is 40%) whereas the mean deviation of the pairs averaged 90° apart is only of the order of one-half to three-quarters of 1%.

Measurements made on a sample of green silk cloth of regular weave are shown in Fig. 4. The center curve is for the sample when rotated and the two outside curves show the spectral reflection of the sample at two azimuths 90° apart. The averaged values for eight azimuths, shown in Table 6, correspond very closely to the value when the sample is rotated.

The sample just considered exhibited no irregularities when averaged according to the 90° method. Fig. 5 shows the results obtained with a sample of rayon at one wavelength (400 μ) for every 22.5° (see Fig. 2). It is immediately seen that this sample does not obey the rule of 90° averaging. A careful inspection of the fabric disclosed that at some positions

TABLE 6

Wavelength = 500 μ

Azimuth (Degrees)	Reflection Factor (%)
0	61.95
45	61.90
90	63.40
135	63.45
180	61.95
225	61.90
270	63.40
315	63.50

Average of 8 Azimuths = 62.68
Value when Rotated = 62.70

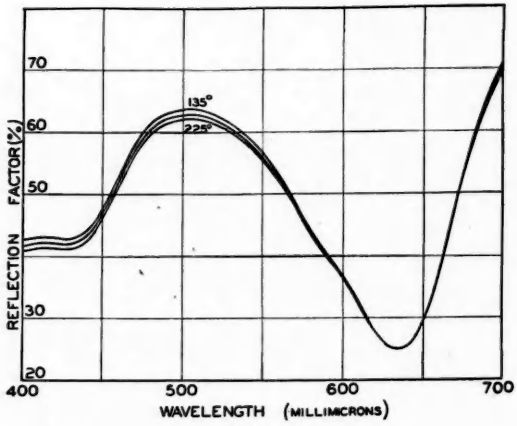

FIG. 4

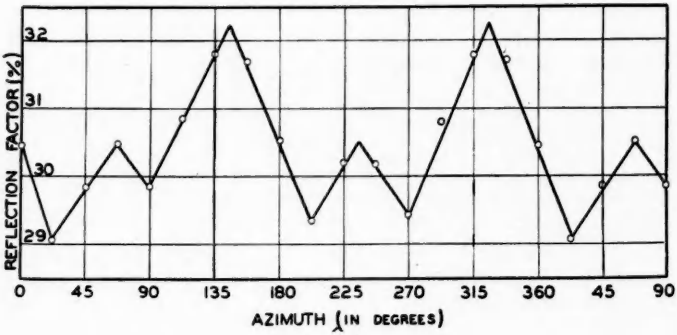

FIG. 5

light was directly reflected into the photoelectric cell of the spectrophotometer, instead of being first diffusely reflected from the walls of the integrating sphere. If the photoelectric cell is properly shielded, the regular characteristic curve that would be expected is obtained and is shown in Fig. 6 for measurements made at the same wavelength (400 μ). The

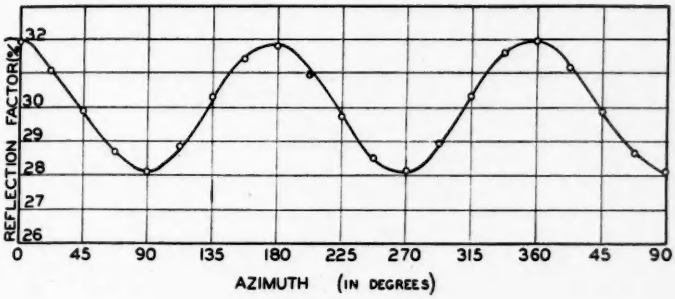

FIG. 6

spectrophotometric curves for this sample of rayon for two positions 90° apart and when rotated are shown in Fig. 7. The photoelectric cell was shielded from the direct reflection of the sample in making these determinations. Numerous other types of materials have been examined but it is impractical to present all of the results here. It may be stated however that even two-toned cloth woven from cotton and rayon, or pile fabrics having the pile laid in one direction, are found amenable to this method of averaging to a precision that is considered to be adequate.

A method for examining samples that exhibit polarization has been previously suggested by McNicholas.[2] He proposed to locate the plane of minimum reflection by noting the nature of the weave and to measure the sample at 45° from this position. This method is open to some practical objection; often it is not possible to locate the plane of minimum reflection of a material such as a textile fabric by a simple inspection of the weave. To locate such a position in the measuring instrument is not sufficiently precise because, at this position, the values are the least sensitive to alteration of the position. Furthermore, the minimum reflection at one wavelength may not be the minimum at another. For these reasons it is recommended that the sample be measured in two positions 90° apart and the results averaged to obtain the reflection factor for normal, unpolarized light.

Mathematical Proof of Averaging Method

The mathematical proof of this method of averaging is given as follows. It should be stated, as a matter of practical spectrophotometry, that it is usually found more convenient to turn the textile sample through 90° rather than to rotate the incident beam, but the following considerations apply equally well in either case:

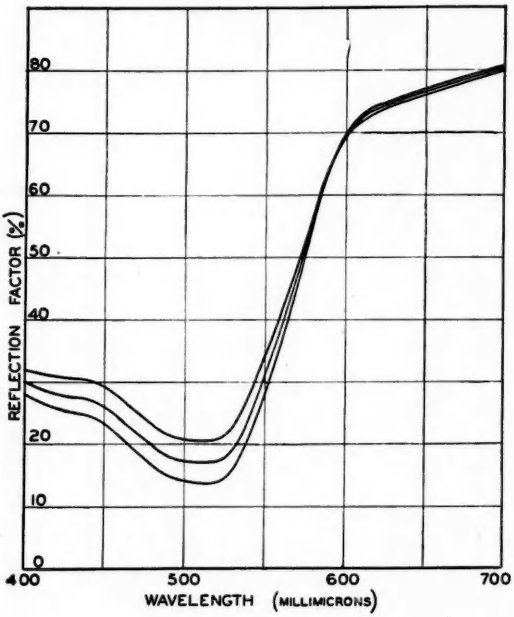

FIG. 7

Let a beam of plane-polarized light of amplitude "a" and intensity "I" be incident normally on the surface of the sample. Let this beam be resolved vectorially into two components at right angles, having the same phase and frequency. The amplitudes of these components will be referred to as "a_1" and "a_2" and the diffuse reflection factor of the sample in the direction of these vectors will be called "R_1" and "R_2" respectively.

Referring to Fig. 8, let the angle between a and a_1 be designated by θ_1. The intensities of the two components reflected by the sample are $R_1a_1^2$ and $R_2a_2^2$, respectively. The total intensity of light diffusely reflected from the sample is $R_1a_1^2 + R_2a_2^2 = I_1$.

Since $$a_1 = a \cos \theta_1,$$

and $$a_2 = a \sin \theta_1,$$

then $$I_1 = (R_1a^2 \cos^2 \theta_1 + R_2a^2 \sin^2 \theta_1).$$

Now turn the beam of amplitude "a" through 90° so that a new angle "θ_2" is made with "a_1," as shown in Fig. 9. The total intensity of the

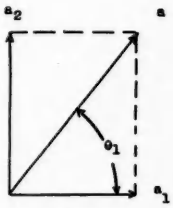

FIG. 8

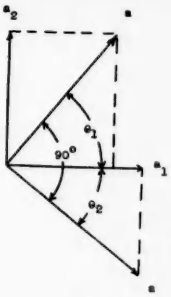

FIG. 9

light reflected from the sample in this case is I_2, whence

$$I_2 = (R_1a^2\cos^2\theta_2 + R_2a^2\sin^2\theta_2).$$

The average total intensity for these two positions

$$= \frac{I_1 + I_2}{2}$$

and $$\frac{I_1 + I_2}{2} = \frac{(R_1a^2\cos^2\theta_1 + R_2a^2\sin^2\theta_1) + (R_1a^2\cos^2\theta_2 + R_2a^2\sin^2\theta_2)}{2}.$$

Since $$\theta_1 + \theta_2 = 90°,$$

then $$\cos\theta_1 = \sin\theta_2$$

and $$\sin\theta_1 = \cos\theta_2.$$

By grouping similar terms and substituting:

$$\frac{I_1 + I_2}{2} = \frac{a^2}{2}R_1(\sin^2\theta_2 + \cos^2\theta_2) + R_2(\cos^2\theta_2 + \sin^2\theta_2).$$

This can be reduced to: $$\frac{I_1 + I_2}{2} = \frac{I(R_1 + R_2)}{2},$$

or $$I_{Ave.} = \frac{I(R_1 + R_2)}{2}.$$

Unpolarized light may be considered as light polarized in all azimuths simultaneously, and the average intensity of such a beam of reflected light may be represented by $I_{Ave.}$:

$$I_{Ave.} = I\sum\frac{(R_1 + R_2 + \ldots + R_n)}{n}$$

Where: I = Intensity of light incident normally on sample
R_n = Reflection factor at any azimuth

The reflection factors of any of these positions (R_1, R_2, R_n) may be resolved into two components at right angles to each other and having the values $R_1' + R_2'$.

Then: $$\sum \frac{(R_1 + R_2 + \ldots + R_n)}{n} = \frac{R_1' + R_2'}{2}.$$

Therefore: $$I_{Ave.} = \frac{I(R_1' + R_2')}{2}.$$

This expression is identical to the one expressing the average intensity of plane-polarized light at two azimuths 90° apart.

In conclusion, it is recommended that the spectrophotometric examination of samples exhibiting polarization be made either with the sample rotating, or, if this is impractical, at two azimuths 90° apart and the results averaged arithmetically to obtain the reflection (or transmission) factor for ordinary unpolarized light.

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2. H. J. McNicholas. *B. S. J. Rsch.*, *1*, 793 (1928).
3. W. D. Appel. *Am. Dye. Rptr.*, *17*, 49 (1928).
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Continued from page 390

if the largest possible profit is to be gained from this modern tool of industry:

> "Above all things, let there be some one in every textile enterprise who is capable of that peculiar, logical, quantitative contemplation of the material about him, which is the scientific point of view and let him be no mere user of scientific methods of analysis, no mere tester, but a trusted thinker, who is to become more and more a trusted executive."

Silk Fibroin Dispergation

By MEARL A. KISE*

Summary

By means of specially developed techniques for using the glass electrode, the ninhydrin test and the method for the determination of amide nitrogen, several properties, including the isoelectric points, the acid-base titration curves, the amide nitrogen, amino nitrogen and the specific rotations of a number of samples of regenerated fibroin were compared. The samples which had been dispersed in lithium bromide solution, resorcinol, hydrochloric acid or alkaline glycerol copper sulfate solution, representing the various types advocated in practice, were compared with untreated samples under exactly the same conditions. The following conclusions were reached:

1. Regenerated fibroin, obtained from the solutions mentioned, had essentially the same chemical characteristics as undispergated fibroin. This result was in agreement with that of Abderhalden and Brockman.[23] These investigators reported no change in the particle size of fibroin exposed to lithium bromide solutions various lengths of time and at various temperatures. This conclusion also gave further credence to the work of von Weimarn in which, under proper spinning conditions, regenerated fibres were obtained having a tensile strength as high as that of the original fibres.

2. The exposure of silk fibres to the action of water at temperatures as high as 130° had a deteriorating effect upon the protein when the action was prolonged. A portion of the fibroin was decomposed, the fibres were weakened and became more easily disintegrated mechanically and more readily dispergated. These effects would be of use in the dispergation of the more difficultly dispersed silks, provided the decomposition which was produced was not sufficient to affect materially the physical properties of the resulting regenerated fibres.

3. In the regeneration of fibroin containing small amounts of decomposition products of the protein, there was a tendency for the protein decomposition products to remain dispersed unless the coagulation was very thorough. This is desirable in the respinning of silk fibres.

* Dr. Kise is a Senior Fellow of the Textile Foundation working under the direction of Prof. Treat B. Johnson, Sterling Professor of Chemistry, Yale University, New Haven, Conn.

4. The titration curve for silk fibroin showed a large base combining power compared to the acid combining power. This is due, possibly, to the large number of acidic tyrosine hydroxyl groups present in fibroin.

5. The electrometric titration curves indicated an isoelectric point of about pH 3.2 for the silk fibroin of Italian yellow silk.

Introduction

FOLLOWING the extensive investigations of von Weimarn[1] upon the dispergation and aggregation of natural silk in aqueous solutions of neutral salts, numerous methods were patented for the solution and regeneration of natural silk fibres. The processes, in general, have been variations of the procedures employing concentrated solutions of organic or mineral acids,[2] neutral salts,[3] alkaline nickel or copper sulfate,[4] polyhydroxyphenols[5] and liquid ammonia.[6] The success of these various methods is dependent upon, among other things, the extent to which the fibroin remains unaltered chemically throughout the treatment. Regenerated filaments of the unaltered fibroin in which the micelles have been suitably oriented by proper mechanical treatment have been reported to equal or exceed the original fibres in tensile strength.[1] However, if the fibroin is partially decomposed during the dispergation, and the length of the chain-molecules is decreased, as in the case of treated cellulose,[7] the tensile strength of the resulting filaments must necessarily be less than that of the original fibres. The purposes of the present investigation have been, therefore, to study the changes that have occurred in regenerated fibroin which has been dispergated by various representative reagents, and to determine which type of reagent has the least deteriorating effect upon the silk fibroin. The results are of practical importance, since the fibroin must be dispergated without chemical decomposition in order to obtain regenerated fibres of good quality.

In accordance with his theory von Weimarn has shown that wool,[8] chitin, casein, silk, fibroin and cellulose can be dispergated in concentrated aqueous solutions of a great number of salts.[9] Attempts have been made to spin filaments of a number of these proteins besides silk.[10] The ease of dispergation varies among different substances as well as among different samples of the same substance. The hard natured silks, as Chinese, dispergate more slowly than the soft natured silks, as Italian. Tussah silk does not dispergate in lithium bromide solution, but can be dispersed in concentrated acids. The ease of dispergation is dependent also upon the past history of the sample. Recent studies on wool[11] have shown that dispergation, in this case, is dependent upon the splitting of the disulfide linkages. Reagents such as potassium cyanide and thioglycollic acid, which are capable of breaking these linkages, readily dissolve wool. von Weimarn stated that, in general, the preeminent part in dispergation is played by a certain state of hydration, and the chemical nature of the salts has only a secondary rôle.

Liquid silk from the seripterium of the worm disperses spontaneously in boiling water and 5% aqueous sodium chloride or potassium carbonate.[12] The liquid, a concentrated colloid system, is coagulated by mechanical action

as pressing or stretching, by the action of acids and by heating to boiling. The investigators concluded that coagulation is a physical process and is not dependent upon enzyme action.[13] The process of dispergation, as indicated by von Weimarn, begins with a progressive swelling of the thread. This is followed by the appearance of multitudes of fibrils of ultramicroscopic dimensions due to "fibril cleavage." The superficial layer of the strongly swollen thread disintegrates into drops of a viscous liquid which finally disappear into the solution of the salt-dispergator.

For the purposes of comparative studies on fibroin, several dispergation reagents were chosen which were representative of the great number recommended. Samples of purified fibroin were dispersed in concentrated hydrochloric acid, 50% lithium bromide solution, molten resorcinol and alkaline glycerol-copper sulfate solution.[14] In accordance with certain patents, attempts were also made to dispergate fibroin in liquid ammonia. It was found, in substantiation of the results of Taft and McChesney and Miller,[15] that untreated silk fibroin did not disperse in liquid ammonia. The samples of dispersed fibroin were precipitated with acetone, freed of traces of the dispersing agents by boiling with water, dried and pulverized in a ball mill. Colloidal solutions of the variously treated samples, prepared by stirring the powders into boiling water, were then compared with similarly prepared solutions of the undispergated fibroin.

Experimental

Purification of Silk Fibroin. One skein (74 grams) of good quality Italian yellow silk was degummed by heating it with 700 ml. of distilled water under pressure at 120–130° C. for three hours.[16] The fibres were then rinsed several times with hot water. This procedure was carried out three times. The silk was then extracted with hot ethanol, soaked for 10 minutes with hot water and finally extracted in a soxhlet for four hours with ethanol. After pressing free of ethanol, the fibres were extracted with ether for six hours, air dried and stored in a desiccator. The weight of the dry skein was 50 grams.

A second skein (53 grams) of the same lot of Italian yellow silk was degummed by treating it with 1500 ml. of a 1.5% solution of neutral olive oil soap at 90–100° C. for 20 minutes. The skein was then rinsed twice in a liter of hot water. This procedure was repeated three times. Finally, the fibres were warmed 20 minutes at 60° C. in 1500 ml. of a solution containing 10 ml. of ammonium hydroxide. After rinsing several times with warm water, the silk was warmed 20 minutes with 1500 ml. of a solution at 60° C. containing 10 ml. of concentrated hydrochloric acid. The fibres were rinsed and then soaked for 20 minutes in distilled water at 60° C. The silk was pressed free of water, extracted for 10 minutes with hot ethanol, again soaked in hot water at 90° C. for 10 minutes and finally extracted in a soxhlet with ethanol for six hours. After pressing the fibres free of ethanol they were extracted with ether in a soxhlet for six hours, air dried and stored in a desiccator. The weight of the air-dried fibres was 38.5 grams.

Dispergation of Silk Fibroin. Ten gram quantities of the pressure-degummed and soap-degummed silks were dispergated in the following substances by adding small portions of the shredded fibres to the solutions at the temperatures indicated during the periods of time recorded.

Solutions	Temperature °C.	Time (Minutes)
100 grams resorcinol	120–130	25 min.
100 ml. hydrochloric acid (sp. gr. 1.2)	−5–0	60
100 ml. alkaline glycerol [14] copper sulfate	60–70	30
50 ml. 50% neutral lithium bromide	70–80	35

The clear solutions were diluted with equal volumes of water and cooled to room temperature where necessary. The alkaline copper sulfate solution was diluted with an equal volume of dilute acid in place of water. The acid contained in the solution was just sufficient to neutralize the base present. The dispersed fibroin was then precipitated by adding two to three volumes of acetone to the various solutions and allowing them to stand for several hours. The regenerated fibroin was removed from the suspensions by filtration and triturated with hot water several times until free of the dispergation reagents. The respective washings were tested for bromide, chloride and sulfate ions in the usual manner. The presence of resorcinol in the washings from resorcinol dispergated fibroin was detected by the use of fructose. The customary resorcinol test for keto hexoses was carried out. After thoroughly macerating the precipitated fibroin and removing the traces of the dispersion agents, the samples were extracted for several hours in a soxhlet extractor with acetone. The samples of dried, friable powders, representing about 90% of the weight of the original fibres, were pulverized by grinding each sample for two weeks in a ball mill. The mill was 8 in. long and 6 in. in diameter and contained six porcelain balls, each weighing about 30 grams.

In order to obtain standards for the comparisons, samples of the pressure- and soap-degummed silks were powdered in a ball mill. One gram portions of the shredded fibres were added daily to the mill until 10 grams had been added. The fibroin was ground for two weeks.

Preparation of Colloidal Fibroin Solutions. The samples of fibroin were colloidally dispersed in water by sifting about six grams of the fine powders into 100 ml. portions of boiling distilled water. A small amount of toluene was added to each suspension and it was then electrodialyzed for about eight hours, using a potential of 220 volts. The membranes of the dialyzing sacks were made from sheet Cellophane. The water in the anode and cathode compartments was changed constantly. The temperature of the solutions was never allowed to rise above that of the room. The current strength became constant at about 10 milliamperes after several hours of electrodialysis. After the completion of the dialyse, the suspensions were filtered through hardened filter paper. The resulting pale yellow solutions, containing 1–2% of silk, were electrometrically titrated and analyzed for amino nitrogen, as will be described. The optical rotation of each solution was determined and the exact protein content evaluated by Kjeldahl analysis. The insoluble material of the suspensions was dried and analyzed for amide nitrogen. Because the powders were contaminated with varying amounts of an insoluble dust worn from the ball mill, each sample residue was analyzed for total nitrogen and the amide nitrogen determinations corrected accordingly. The analyses for amide nitrogen were made by a semi-micro method recently published.[17]

Amino Nitrogen Determination. Since fibroin contains only a small amount of free amino nitrogen, about 0.07%,[18] an increase due to a small

amount of hydrolysis would cause an appreciable change in this value. However, for the amino nitrogen analysis of limited quantities of 1–2% solutions, the van Slyke procedure was obviously inadequate. Therefore, the ninhydrin color test for amino acids,[19] suitably modified, was used to estimate the amino nitrogen. The amount of amino nitrogen in a measured quantity of silk solution was determined by comparing the color produced in the test to that of an alanine standard. The standard was prepared by heating together in a water bath for 20 minutes, 1 ml. of an alanine solution (0.05 milligrams of nitrogen per ml.), 1 ml. of water, 0.1 ml. of pyridine and 0.4 ml. of a saturated solution of triketohydrindene.[20] At the same time 2 ml. of the silk solution was heated in the same manner with the same quantities of pyridine and ninhydrin reagent. The colors produced were diluted to 100 ml. in volumetric flasks and compared in a colorimeter. For reasons which will be discussed later, the initial volumes of all the test mixtures were 2.5 ml. and the amount of color-producing protein in each mixture was made as nearly equal to that of the standard as possible. Thus, in testing the more concentrated silk solutions, less than 2 ml. of the unknowns were used and the balance was made up with distilled water.

Preliminary experiments with solutions of casein and gelatin showed that reproducible amounts of color could be obtained with less than 4% variation in the readings. Variations in the length of the heating period from 15 to 30 minutes, or small changes in the pH of the protein solutions, did not affect the amount of color produced. Further, upon dilution the color intensity followed Beer's law. However, it was found that, in the formation of the color during the heating process, the amount of color which was produced varied with the concentration of the protein in the solution, although the total amount of protein present was constant. When decreasing amounts of a gelatin solution were tested in a constant volume of test mixture (2.5 ml.), the amount of color produced per unit weight of protein gradually became less. By plotting a number of determinations the amount of color produced per unit weight of protein was found to be proportional to the logarithm of the protein concentration. Thus, at the concentrations most conveniently employed, an increase of 100% in the protein concentration in the test mixture caused about a 12% increase in the amount of color produced per unit weight of protein.

In order to compare the ninhydrin and van Slyke methods for determining the amino nitrogen, 3 and 5% solutions of casein and gelatin, respectively, were analyzed for amino nitrogen by the van Slyke procedure. The solutions were then diluted to five times their original volumes and tested by the ninhydrin method just described. A comparison of the results revealed that the ninhydrin values were about 0.84 and 0.71 of the van Slyke values for gelatin and casein, respectively. Apparently, the amount of color produced per unit of amino nitrogen was characteristic of each protein. The limitations of the test were obvious. Nevertheless, for the comparison of dilute solutions of silk containing extremely small amounts of amino nitrogen, the method was of use. The discrepancies pointed out indicated that when comparing solutions containing approximately the same amount of amino nitrogen, determined exactly as described in the method of procedure, variations of about 20% or less could not be seriously considered. The test, therefore, gave only the order of magnitude of the amino nitrogen. Since the value is about 0.1% for silk, variations of 20% or less were of little importance.

Electrometric Titration. For the purpose of comparing the isoelectric points and the acid and base binding powers of the variously treated fibroin samples, the electrodialyzed solutions were titrated electrometrically.

Apparatus. The glass electrode system which was used was similar to that described by Hendrix and Wharton.[21] The pH measurements were made with the aid of a Leeds and Northrup shielded potentiometer equipped with a temperature compensator. The potentiometer, model No. 7657, was calibrated in pH units. Because of the limited quantities of silk solutions which could be conveniently made available, the glass electrode was not used in the customary manner but was arranged as in Fig. 1. All the pH

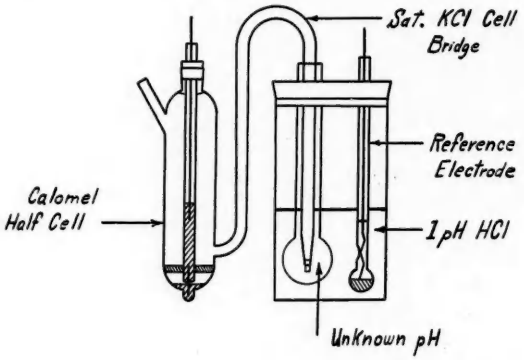


FIG. 1.

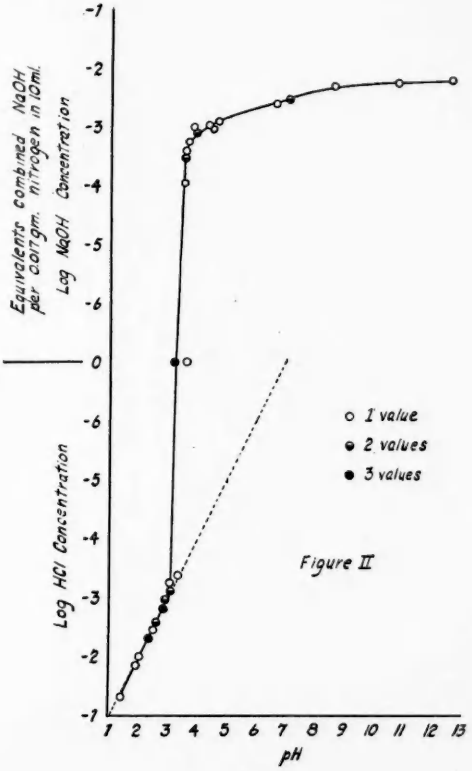
measurements were made in an electrically controlled air thermostat kept at 25° C. ± 0.2.

Titration Procedure. A series of points for each solution was obtained by the following procedure: Five cc. portions of the solution were measured into 10 cc. volumetric flasks. Measured amounts of 0.1N or .01N hydrochloric acid or sodium hydroxide were added and the flasks were filled to the graduation marks with boiled distilled water. After mixing a solution thoroughly, a small portion was used to rinse the inside of the glass electrode bulb twice. The remainder of the solution was poured into the glass bulb. The glass electrode was filled well into the neck. The electrode was placed in the circuit and the system allowed to come to equilibrium. After measuring the pH of the solution, the procedure was repeated with the other mixtures. The system was calibrated with a standard acetate buffer solution before and after each series of titrations. The determinations were accurate within 0.05 pH unit.

In order to conserve space, the data for all the solutions were plotted in a composite curve given in Fig. 2. Since the values for the eight different solutions formed essentially one curve the points were not distin-

guished as to the solution of their origin. In several instances, where the same position was held by more than one point, the position was marked by a distinctive circle, as explained in the legend.

Isoelectric Points. In accordance with the findings of von L. Reiner and others,[22] the various electrodialyzed solutions were considered to be



practically at their isoelectric points. The pH determinations made upon the undiluted solutions are recorded in the table. The validity of this assumption will be discussed later when a comparison will be made between the values obtained in this way and those arrived at from the titration curves.

TABLE 1

Sample	Nitrogen $\times 10^{-4}$ gram/cc.	Rotation		Amino Nitrogen %	Amide Nitrogen %	Isoelectric Point pH
		Obs.	25° d			
P0	28.67	−0.835	−54.0	0.10	0.52	3.17
P1	36.87	−1.113	−55.8	0.12	0.57	3.12
P2	29.85	−0.923	−57.4	0.13	0.57	3.14
P3	27.10	−0.793	−54.3	0.11	—	3.12
PX	37.25	−1.440	−56.7	0.10	—	—
PY0	36.46	−1.067	−54.4	—	—	—
PY4	24.00	−0.712	−54.3	—	—	—
S0	34.97	−1.094	−58.0	0.09	0.68	3.31
S1	34.45	−1.073	−57.9	0.13	0.78	3.09
S2	23.41	−0.709	−56.2	0.09	—	3.23
S4	20.73	−0.662	−59.2	0.10	0.62	3.62
WX	17.33	−0.547	−58.6	—	—	—

Nitrogen Content of the Italian Silk Fibroin:

Corrected for ash and moisture	%
Soap degummed fibres of Italian yellow silk	18.58
Insoluble residue from colloidal solution of S0	18.54
Sample S4	18.55
Sample S2	18.50
Average	18.55

Explanatory Note

P = A skein degummed by water under pressure at 120–130° C. as previously described. Samples 0 to 3 inclusive were prepared from this skein.

S = A skein degummed by soap solutions as indicated previously. Samples 0 to 4 inclusive were prepared from this skein.

0 = Samples prepared by grinding untreated, degummed fibres to a powder in a ball mill.

1 = Samples prepared by dispergation in concentrated hydrochloric acid at 0° C.

2 = Samples prepared by dispergation in melted resorcinol at 120–130° C.

3 = Samples prepared by dispergation in alkaline glycerol copper sulfate solution at 60–70° C.

4 = Samples prepared by dispergation in 50% neutral lithium bromide solution at 70–80° C.

PX = A sample taken from a pressure degummed skein of the same book as the previous skeins. The sample was prepared by dispergation in 50% neutral lithium bromide solution at 70–80° C., dialyzed free of salt, filtered through hardened filter paper and the rotation determined. The solution was analyzed for nitrogen as in the other cases.

WX = A sample prepared from a skein (77.3 grams) degummed by repeatedly boiling it with water for a total of 30 hours. The silk was then extracted thoroughly with acetone and dried. The dry weight was 58.3 grams. The sample was prepared by dispergation in the same manner as PX.

PY = Samples taken from a skein degummed in the same manner as P and PX.

The sample PY0 was prepared in the same manner as the samples P0 and S0, i.e., by grinding in the ball mill.

Sample PY4 was dispergated in 50% neutral lithium bromide solution in the same manner as S4. The dispergation, however, was carried out three times in this case before grinding in a ball mill.

Discussion

For the purpose of clarity in the discussion the following facts should be kept in mind: Colloidal solutions of P0 to P3 and S0 to S4, inclusive, were prepared in exactly the same way from powdered samples of regenerated fibroin. The P and S samples were taken from similar skeins of Italian yellow silk degummed by water at 120–130° C. and by soap solutions, respectively. Therefore, corresponding samples as P1 and S1 were treated in exactly the same way except in the degumming of the skeins. Since considerable variation was evident between the corresponding samples of P and S, a check was made upon the general procedure by treating sample PY0 from a third skein in exactly the same manner as P0. Sample PY4, corresponding to S4, was dissolved in lithium bromide solution three times in order to enhance any effect of the dispergation. To eliminate any doubt concerning the possibility of fractional dissolution in the preparation of the colloidal solutions, samples PX and WX, prepared from separate skeins as indicated, were treated so that the entire protein was retained in the solutions.

The values for the specific rotation of fibroin for all samples showed a maximum variation of about 10%, which was considerably more than could be attributed to experimental error. Considering the pressure- and soap-degummed silks separately, the variation among variously treated samples was much less. The values for the soap-degummed samples were, in general, higher than those of similarly treated pressure-degummed samples. Obviously, pressure degumming gave rise to a different quality of fibroin from soap degumming. This was not surprising in view of the fact that pressure-degummed skeins lost about 5% more weight than soap-degummed skeins. The former were also more readily disintegrated in the ball mill and more readily dispergated. Further, when a soap-degummed skein was given a pressure degumming treatment it lost an additional 5% in weight. The concentrated extracts yielded a series of water-soluble protein degradation products which had an average nitrogen content of 14.3%. The extracted material was undoubtedly decomposition products from a portion of the silk.

Recent investigators [23] reported the separation of a diffusible fraction which amounted to about 7% of the fibroin. Since it was possible that certain degradation products or polypeptides existed within the filaments, these experiments were repeated. Twenty grams of pressure-degummed silk were dispersed in 50 cc. of 50% neutral lithium bromide solution at 70–80° C. The solution was dialyzed free of salt in a continuous vacuum dialysis apparatus [24] whereby all the diffusing material was obtained in a concentrate. The amount of nitrogenous material mixed with the lithium bromide amounted to about 0.5% of the dispersed silk. About 5% of the diffusible nitrogen existed in the form of ammonium salts and several per cent as amino nitrogen. However, repeated experiments with Cellophane membranes never gave more than 0.5% of diffusible material. The previous investigators suggested that this material might have been residual sericin. Dialysis experiments with sericin, however, gave no appreciable amount of diffusible material. Apparently, the material obtained in the dialysis experiments was degradation products produced by the dispergation, the pressure degumming, or originally contained in the fibres of the silk, the amount depending on the past history of the silk.

From the specific rotations, it was further apparent that those samples which had been dispersed showed higher numerical values than the untreated samples. Had appreciable hydrolysis taken place the values should have decreased numerically.[25] This anomaly was explained by assuming that the protein fragments contained in the degummed fibres remained in the dispersion solutions after the coagulation of the main portion of the fibroin, since additional coagulum separated from the filtrates on standing several hours. The more soluble protein fragments most likely remained in the dispersion medium unless coagulation was made exceptionally thorough. Evidence to this effect was gleaned from the fact that sample PY4 had the same specific rotation as samples PY0 and P0. In coagulating the fibroin of sample PY4 more than double the usual amount of acetone was used and the suspensions were allowed to stand 24 hours before removing the coagulums.

A comparison of the rotations of samples PX and WX with the average of those for pressure-degummed and soap-degummed samples, respectively, showed practically no difference. Apparently, the solutions prepared by colloidal dispersion of the powders and those prepared by dispergation and dialysis had the same protein composition. There was no evidence of fractionation in the colloidal dispersion of the powders.

It was apparent that the different methods of degumming caused a greater alteration in the fibroin than dispergation in any of the reagents. The regenerated fibroin was essentially the same, chemically, as the original degummed fibres.

The percentages of amino nitrogen were in no case indicative of any appreciable amount of hydrolysis. The values of several samples, particularly those of pressure-degummed samples, showed a slight increase. The values for free amino nitrogen approximated that of Meunier and Rey of 0.07%, determined by a modified van Slyke procedure.[18]

The values for amide nitrogen were essentially unchanged by dispersion. However, the values for pressure-degummed samples were approximately 20% lower than those of soap-degummed samples, due probably to the hydrolytic action of the water at 120–130° C. upon the amide groups.

The data secured by the electrometric titration of the various electrodialyzed solutions were combined in a curve shown in Fig. 2. The data for the acid titration branch of the curve were plotted as obtained for each solution without corrections for the variations in the protein content of the solutions. The broken line represents the theoretically and experimentally determined pH values for various concentrations of hydrochloric acid. Several points which were determined for the pure acid solutions were within the limit of error of the pH determinations, but were omitted from the curve to avoid a confusion of points. To simplify the curve, a number of the determinations from different solutions which fell at the same positions were represented by single points appropriately labeled. Assuming that the activity coefficient of the hydrogen-ions was the same in the acid-protein-mixture as in the pure acid of equal hydrogen-ion activity,[26] the dotted line becomes a blank correction curve. It is then obvious that the titration curve shows no appreciable amount of combined acid, since the addition of acid to the protein solution resulted in the same pH value as the same concentration of pure acid. This does not mean than the fibroin did not combine with any acid, but rather that the amount combined per gram of silk was too small to produce an effect upon the pH in such a high

concentration of hydrogen ions and with such a low concentration of fibroin. However, the curve showed definitely that all the samples were alike in this respect and that no appreciable hydrolysis had taken place during dispergation to cause the fibroin to bind large amounts of acid. In order to make the various solutions comparable and to have a continuous acid-base titration curve, the values for the base titration branch of the curve were corrected for variations in the protein concentration of various solutions by calculating all points to the common basis of the average protein concentration, which was equal to 0.017 gram of nitrogen per 10 ml. The equivalents of combined alkali, contained in 10 ml. of titration solution, were then plotted in terms of concentration. The curve was similar to that for aspartyl-aspartic acid.[27]

When exposed to gaseous ammonia fibroin exhibited a base combining power of 86×10^{-5} moles per gram.[28] The present electrometric titration indicated a base combining power of about 65×10^{-5} moles per gram, while the value calculated from the amino acid composition of fibroin was 55×10^{-5} moles per gram.[28] The theoretical value was determined almost entirely by tyrosine, since fibroin contains only comparatively small amounts of aspartic and glutamic acids. The agreement of the three values is fairly good. However, it was found that the hydroxyl group of tyrosine did not combine with gaseous ammonia,[28] but only with base in aqueous solution.[28] If similar conditions prevailed in fibroin, the first figure recorded should be negligible compared to the second. Since the values are approximately the same, the hydroxyphenyl group in fibroin must be more acidic than that in the amino acid. The hydroxyl group in the tyrosine rest of the fibroin is apparently the predominating factor in the base binding power of fibroin. The binding powers of the variously treated samples were practically the same, which again indicated that no change was caused by the processes of dispergation.

The isoelectric points as determined from the pH values of the electrodialyzed solutions are recorded in the table. Within reasonable limits, the values are those which could be taken from the titration curves. These findings are in agreement with those of von L. Reiner and others [22] who found that protein solutions upon sufficient electrodialysis approached pH values which coincided with the isoelectric points of the proteins. The isoelectric points of the pressure-degummed samples, however, were slightly more acid than those of the soap-degummed samples. This was possibly because a number of the amide groups in the fibroin were hydrolyzed to carboxyl groups by degumming with water at 120–130° C. The average value of the isoelectric point was about pH 3.2. This value differs from those obtained by other methods in which values from pH 1.5 to 7.2 have been reported.[30] The statement that the isoelectric point is characteristic of each type of silk [21] is plausible in view of the fact that tyrosine plays such an important part in the acid-base relationship of fibroin and that the tyrosine content for different silks has been reported to vary considerably.[32]

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Dr. Katz Lectures on Starches

DR. J. R. KATZ, director of U. S. Institute's warp sizing research, gave an illustrated lecture on starches at Massachusetts Institute of Technology, Cambridge, Mass., Saturday, June 29, which was attended by members of the administration and advisory committees for this study, and by representatives of the 55 contributing members of U. S. Institute who have either co-operated in the financing of the research or have registered to receive its confidential progress reports. Following the lecture there was a question and answer period.

The literature survey of this project having been nearly completed by Dr. Katz and his associate, Mr. Yelland, they conferred with the administration and advisory committees at an afternoon session on matters having to do with current warp sizing practice. The research directors then conferred with the administration committee as to work in progress and the program of future work.

New Contributing Members

In addition to the manufacturers and allied firms who are co-operating in the financing of this study the following have recently become contributing members of U. S. Institute for the purpose of receiving confidential progress reports of the warp sizing research: Bigelow-Sanford Carpet Co., Thompsonville, Conn.; Bloomsburg (Pa.) Silk Mill; Drake Corp., Norfolk, Va.; Fairforest Finishing Co., Spartanburg, S. C.; Farr Alpaca Co., Holyoke, Mass.; Hart Products Corp., New York, N. Y.; National Adhesives Corp., New York, N. Y.; North American Rayon Corp., Elizabethton, Tenn.; Penick & Ford, Ltd., New York, N. Y.; The Texas Co., New York, N. Y.; Tubize Chatillon Corp., New York, N. Y.

Abstracts

This section is compiled under the direction of the Committee on Abstracts and Bibliography: Prof. E. R. Schwarz, Chairman, Dr. W. E. Emley, Prof. Louis A. Olney and M. W. Weiss.

I. Fibres (Synthetic and Natural) and Fibre Analysis

Amino Nitrogen Contents of Wool and Collagen. Milton Harris and Joseph R. Kanagy. *Am. Dye. Rptr.*, April 8, 1935, P. 182–7.

When wool, collagen and arginine were treated with nitrous acid, increasing amounts of nitrogen were evolved with time. The continued evolution of nitrogen was due to the action of nitrous acid on the guanidine nuclei of these materials. A new method for the determination of the arginine content of a protein is given. The method is based on the relative rates of evolution of nitrogen from the guanidine nuclei in a protein and in arginine. Evidence is presented to show that the action of nitrous acid on the guanidine nucleus is different from its action on a free amino group. The free amino nitrogen contents of wool and collagen were calculated by subtracting from the total nitrogen evolved that portion of nitrogen which came from the guanidine nuclei. The values obtained for the percentages of the total nitrogen as amino nitrogen are 2.53 for wool and 2.77 for collagen. (S)

Chlorination of Wool. Shunpu Utaka. *Repts. Imp. Ind. Rsch. Inst., Osaka, Japan*, V. 15, No. 11, P. 1–89, 935; *Chem. Abs.*, 1935, V. 29, Col. 2751. (W)

Domestic Cocoon: Behavior of Aqueous Solution of. XXI. Isoelectric Points of Sericin and Fibroin. H. Kaneko and K. Yamamoto. XXII. Adsorption of Coloring Matter by Sericin. H. Kaneko and Y. Nakazawa. *J. Agr. Chem. Soc. Japan*, 1934, V. 10, P. 1291–4, 1295–7; *Chem. Abs.*, 1935, V. 29, Col. 1643, 2753. (W)

Moisture of Fibres: New Process of Controlling the. Rudolf Setzer. *Z. ges. Textil-Ind.*, 1934, V. 37, P. 582–3.

The moisture content of a hygroscopic substance will be in equil. in the shortest possible time with the relative humidity of the layers of air which are in its immediate neighborhood. If the laws are known which affect the hygroscopic properties of such a substance and if the relative humidity and temp. of the layers of air in its immediate neighborhood are known it is possible to det. the moisture contents of the hygroscopic substance. Such detns. can be carried out by means of a plunge hygrometer,

in which the moisture-sensitive hair thread is located in a perforated cylindrical shaft (500–1000 mm. or more in length). When this shaft is introduced into the hygroscopic material down to half its length it will indicate the relative moisture of the air within the material in a few min. A combination of values calcd. from Muller's formula with values obtained from dependable exptl. data published in a number of reports allows the construction of av. curves of hygroscopicity for various temps. with a tolerance of ± ¼%. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 931.) (W)

SYNTHESIS OF NATURAL PRODUCTS: NEW WAYS TOWARDS THE. Dr. Freitag. *Rayon and Mell. Tex. Mo.*, Jan. 1935, P. 56–7.

A very general and brief outline of some of the possibilities of regenerating silk fibroin is noted. The article is brief and very general in nature. (S)

SULFUR CONTENT OF MERINO WOOL—ITS DISTRIBUTION AND RELATION TO FINENESS AND QUALITY. F. N. Bonsma and P. J. Joubert. *S. African J. Sci.*, 1934, V. 31, P. 347–70.

Results show that the S content varies with different individuals and is primarily dependent upon hereditary factors, but in general a gradual increase in S occurs from fore- to hindquarters. A deficiency of cystine in the diet of the animal definitely lowers the S content of the wool. This depression is assocd. with a wool, poor in substance, which indicates incomplete keratinization of the entire fibre plasma. A correlation of 0.0572 was found between the S content and fineness of the wool. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 2373.) (W)

WOOL CARBONIZING PROJECT: REVIEW OF THE. Parts IV and V. Roland E. Derby. *Am. Dye. Rptr.*, May 6, 1935, P. 246–7.

An interpretation for the benefit of textile manufacturers who might not be able to follow in detail the highly technical nomenclature involved in these papers. The first of a series of articles by various authors which will attempt to popularize without loss of scientific accuracy the research work which has been developing over the past few years. The author says that the most striking portion of the work on aluminium chloride carbonizing is the discovery that wool is least affected when the conditions of drying are highest. (S)

TEXTILE RAW MATERIALS: NEW GERMAN. R. Hünlich. *Monatsh. Seide Kunstseide*, 1934, V. 39, P. 463–4; *Chem. Abs.*, 1935, V. 29, Col. 931. (W)

WOOL: ISOELECTRIC POINT OF. A. Wahl. *Rev. gen. mat. color.*, 1935, V. 39, P. 37–8.

The isoelec. point of wool is 5.8 pH. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 1992.) (W)

WOOL: EFFECT OF SODIUM HYDROXIDE OF VARIOUS CONCENTRATIONS ON. R. Jäger. *Monatschr. Textil-Ind.*, 1934, V. 49, P. 17, 39–40; *Chem. Abs.*, 1934, V. 28, Col. 7028. (W)

WOOL FIBRE: CHEMICAL TREATMENTS OF. I. TREATMENT BY CALCIUM HYPOCHLORITE SOLUTIONS. II. MICROSCOPIC RESEARCH ON THE HYPOCHLORITE TREATMENT. H. Sobue and Y. Hirano. *J. Soc. Chem. Ind., Japan* 37 Suppl. binding, 1934, P. 362–9; *Chem. Abs.*, 1934, V. 28, Col. 7028. (W)

WOOL KERATIN: TITRATION CURVE OF. J. B. Speakman and E. Stott. *Trans. Faraday Soc.*, 1934, V. 30, P. 539–48.

From measurements of the swelling of wool fibres at various acidities, the isolec. point was found at a pH of 4.8. H_2SO_4 behaves mainly as a monobasic acid in reaction with wool. Wool does not combine with alkali below pH 7. From the titration curve, the compn. of wool was inferred. The fibres consist of long parallel peptide chains bridged across by salt linkages, without an excess of acid side chains. (Copied complete from *Chem. Abs.*, 1934, V. 28, Col. 6609.) (W)

WOOL PRESERVATIVES: PRACTICAL EXPERIENCES WITH. Kurt Hartmann. *Z. ges. Textil-Ind.*, 1934, V. 37, P. 444–6.

A no. of H's practical experiences with wool preservatives are highly successful. (Copied complete from *Chem. Abs.*, 1934, V. 28, Col. 7031.) (W)

WOOL SCOURING. H. Turner. *J. Soc. Dyers Col.*, 1934, V. 50, P. 47–8.

The importance of neutralizing the wool and the difficulties of penetration are stressed. (W)

II. YARNS AND FABRICS

BALLOON FABRICS. Dr. Kehren. *Dyestuffs*, March, 1935, P. 1–3. Reprinted from the *Mell. Textilber.* (S)

FLAX YARN QUALITY AND TYPES. S. A. G. Caldwell. *Tex. Mfr.*, Feb. 1935, P. 45.

The first part of an article concerned with the examination of flax yarns for type, quality, and value. The present part discusses the various classes of flax yarns largely based on the source of the flax fibre itself. (S)

NEEDLE OIL AND ITS RELATION TO FULL-FASHIONED HOSIERY KNITTING. H. C. Roberts. *Rayon and Mell. Tex. Mo.*, April 1935, P. 68–70.

The article illustrates certain defects produced in hosiery and stated to be due to the effect of roughened needles and other items of like nature which can be remedied by proper use of oils. (S)

PHYSICAL PROPERTIES OF 44 REPRESENTATIVE HOUSEHOLD AND CAMP BLANKETS. Margaret B. Hays and Bess M. Viemont. *Rayon and Mell. Tex. Mo.*, May, 1935, P. 52–4.

Detailed analyses with certain tests on a number of blankets are noted in a table and the experimental procedure followed for the determination is outlined in brief. (S)

RAYON: SIZING OF. Carl H. Fischer. *Kunstseide,* 1934, V. 16, P. 374–7; 1935, V. 17, P. 18–22.

A review of various sizes. (Copied complete from *Chem. Abs.,* 1935, V. 29, Col. 2754.) (W)

RAYON: SIZING OF. Bruno Müller. *Kunstseide,* 1934, V. 16, P. 436–7.

A description of the use of the Bayer activated C process for the recovery of benzine from wax-linseed oil solns. used for the surface-smoothing of rayon threads. (Copied complete from *Chem. Abs.,* 1935, V. 29, Col. 2754.) (W)

RAYON FILAMENTS: STICKING TOGETHER OF. A. Jaumann. *Kunstseide,* 1934, V. 16, P. 401–3.

A discussion of the influence of the adherence of adjacent filaments on various characteristics of the yarn and fabrics. This trouble occurs to a more or less degree in various steps in the manuf. of the rayon and in the prepn. of the textile. Long standing of wet rayon and drying out, as well as drying under tension, accentuates the trouble. Drying in a good blast of air or brushing tends to correct the difficulty. (Copied complete from *Chem. Abs.,* 1935, V. 29, Col. 2754.) (W)

RAYON'S PROPERTIES. J. B. Quig. *Tex. Wld.,* Jan. 1935, P. 64.

A very brief abstract of a paper delivered at the annual meeting of the A. A. T. C. C., Dec. 7 and 8, 1934, New York City. Four of the large number of charts appearing in the original paper are reproduced and the article makes no attempt to be an exhaustive summary of the paper itself, which was published complete in *Am. Dye. Rptr.,* 1934, V. 23, P. 718–24, 733–4. (S)

SIZE MIXTURES: COMPOUNDING. J. H. Strong. *Tex. Wkly.,* 1934, p. 533.

The purpose of sizing is shown and the effects of starches on cloth are outlined. Recipes for the preparation of pure and heavy sizes are given, and examples and various analyses of size mixings are discussed. (Abstracted by the *Rayon and Mell. Tex. Mo.*)

SIZING: NOTES ON. Anon. *Dyestuffs,* March 1935, P. 25–30.

An article translated and reprinted from *Z. für die Gesamte Textilind.* A general article dealing with the properties of the various types of sizing materials, starches etc. and with the methods of preparing and using the size. (S)

SIZING COMPOUNDS AND THE SIZING OF VISCOSE AND ACETATE YARNS: MANUFACTURE OF. Edgar S. Genstein and S. Newman. *Rayon and Mell. Tex. Mo.,* May 1935, P. 36.

It is stated that in making the sizing compounds not more than 1% variation should be permitted in the final result and it is stated that it is possible to hold within one-half of 1% if desired. Emphasis is placed upon the control of temperature and time together with the other factors connected with the cooking of the starch. It is further stated that the control of pH is important and that technical experts are required in the

preparation and handling of the sizing material. A number of the factors which should be studied and controlled in the application of the size in the slasher are noted, and while the article is brief there is food for thought in the statements made. (S)

SLIPPAGE IN SILK AND RAYON BROAD GOODS: TENTATIVE STANDARD METHOD FOR THE DETERMINATION OF. H. A. Mereness. *Rayon and Mell. Tex. Mo.*, Feb. 1935, P. 27.

This is a paper released on January 16, 1935 by the National Federation of Textiles, Inc., New York City. The article discusses the preparation of the sample and the methods of testing in general. The sample is prepared by sewing with 000 mercerized cotton thread, 14 stitches to the inch, two pieces of the cloth, one 4 × 4 in., the other 4 × 8 in., across one 4-in. end, one-half in. from the end. The 8-in. dimension is across the warp so that the slippage is that of the warp threads on the filling threads. (Opposite procedure can be used to determine the slippage of the filling threads on the warp.) The Scott Serigraph or similar machine is used with an auxiliary device consisting of a 6-ounce clamp used to hold the sample tight and under small tension when fastening the sample to the lower jaw of the machine. A speed of 6 in. per minute with a lower jaw with a separation of jaws of three in. initially is used. It is recommended that elongation or stretch chart be made and that the charts be used as a basis of computation. The diagram shows how the method is applied. (S)

STRENGTH OF FABRICS. W. E. Morton. *Tex. Mfr.*, 1934, V. 49, P. 232.

A brief and general discussion of the effects of yarn regularity, twist, and density of weave on the strength of cotton fabrics. In a number of experiments optimum values of structural density have been found. A few of these results are noted. No definite conclusions are drawn as to an explanation for changes in strength shown in the tests. (S)

STRETCH-OUT CALCULATIONS. John J. McElroy. *Tex. Wld.*, 1934, V. 84, P. 98–9.

A brief discussion with some interesting data as to the number of looms which can be efficiently operated by weavers including a number of the variable factors with some items as to their control. (S)

UNSHRINKABLE FINISH: SOME OBSERVATIONS ON. A. T. King. *J. Soc. Chem. Ind.*, 1934, V. LIII, P. 339.

A "new" fibre and yarn for textile novelty purposes is expected by the writer to result from the new process of the British Wool Industries Research Association for rendering wool unshrinkable. (C)

WEIGHTED SIZES: APPLICATION OF. B. Metais. *L'Ind. Tex.*, 1934, p. 244.

The author gives a critical discussion of the methods, materials and apparatus used in the sizing of cotton warps, when increases in weight varying from 25 to 100% or more are desired. (*Abstracted by the Rayon and Mell. Tex. Mo.*) (S)

WOOL TWISTS. F. W. Noechel. *Tex. Wld.*, 1934, V. 84, P. 74.

In this interesting paper, which Mr. Noechel presented before Committee D–13 of the American Society for Testing Materials on Oct. 19,

are discussed the needle method and two variations of the feeler method for testing twist in single yarns. (S)

WOOLEN RAINCOAT TEXTILES: MANUFACTURE OF PURE. A. Molnar. *Monatschr. Textil-Ind.*, 1934, V. 49, P. 267.

The formation of streaks in raincoat goods is due to the incomplete removal of the sizing. Best results are obtainable by the use of a desizing agent. Biolase N extra powder is well adapted for this purpose. This plant product is more stable to heat than other amylases. The transformation of the starch takes place nearly immediately at 90–5°. The bath is kept at a temp. of 90° and 3 g. of Biolase is added per l. after dissolving it first in lukewarm water. The decompn. products are then removed by rinsing warm in a washing machine. The textile is dyed in the usual manner with supramine dyes or palatine fast dyes. The addn. of an effective wetting agent like Leonil SB increases the penetration of the color and is highly recommended. The goods are made impervious to water by impregnation with proper agents such as Ramasit K concentrate. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 1644.) (W)

YARN CONDITIONING. G. M. Pearsall and N. D. Harvey, Jr. *Tex. Wld.*, 1934, V. 84, P. 2416–17.

Practical tests indicate that high-boiling solvents and nonvolatile penetrants possess the same beneficial effects as water in twist setting and yarn conditioning, and in addn. they penetrate more rapidly and have more lasting effects. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 1255.) (W)

YARN: STATISTICAL VIEW OF VARIATION IN. L. H. C. Tippett. *Tex. Mfr.*, Feb. 1935, P. 49–50.

A study of cotton spinning from a statistical point of view from a card sliver through to the finished yarn and which is an abstract of a paper entitled "Some Applications of Statistical Methods to the Study of Variation of Quality in the Production of Cotton Yarn" which the author read before the Industrial and Agricultural Research Section of the Royal Statistical Society, England, Jan. 24, 1935. The author mentions the nature of certain yarn variations and the investigation of yarn count irregularity in mills. Several tables are included. It is noted that some variation is found between the second and third drawing. It is stated that these are probably due to short wave draft irregularity and for the time being at least they are regarded as being in some measure inevitable. The article is of interest in connection with articles by Mr. Lee, Textile Foundation Fellow, published in *Textile Research* and relating to regularity and irregularity in roving, sliver, and yarn. (S)

III. CHEMICAL AND OTHER PROCESSING (NOT OTHERWISE CLASSIFIED)

ABSORPTION OF ACID BY WOOL. H. J. Henning. *Angew. Chem.*, 1934, V. 47, P. 771–2; *Chem. Abs.*, 1935, V. 29, Col. 605. (W)

ABSORPTION OF SUBSTANTIVE DYESTUFFS BY CELLULOSE AND ITS MODIFICATIONS. A. M. Patel. *Dyer*, 1934, V. 72, P. 429–30, 433; *Chem. Abs.*, 1935, V. 29, Col. 929, 2748. (W)

ACETATE RAYON DYEING: PRINCIPLES AND PRACTICE OF. E. Ferber. *Chem.-Ztg.*, 1934, V. 58, P. 429–31; *Chem. Abs.*, 1935, V. 29, Col. 1989. (W)

AQUEOUS SOLUTIONS: USE OF—OF BROMINE FOR THE PRODUCTION OF THE UNSHRINKABLE FINISH ON KNITTED WOOLEN GOODS. S. R. Trotman and H. S. Bell. *J. Soc. Chem. Ind.*, 1935, V. 54, P. 30–3T; *Chem. Abs.*, 1933, V. 27, P. 4085.

Neither loss of tensile strength nor diminution of extensibility was produced by bromination. The capacity of brominated wool for absorbing H_2O and alk. soln. was not much different from that of the untreated sample. Treatment with 2% of Br reduced shrinkage 50%, and damaged fibres were negligible in expts. on woolen half hose. The fastness to soap was the same for dyed samples of brominated wool and for untreated yarn. Brominated wool is between untreated and chlorinated wool in regard to the absorption of direct and mordant dyes, but much more like untreated than chlorinated wool. However, the affinity of brominated wool for basic dyes is practically the same as that of chlorinated wool, both absorbing the dye readily from a cold soln. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 2752.) (W)

AZINE DYES: REACTIONS LEADING TO SYNTHESES OF. Robert Lantz. *Ann. Chim.* (11), 1934, V. 2, P. 58–99; *Chem. Abs.*, 1935, V. 29, Col. 2745. (W)

BASIC DYES: DETERMINATION OF—BY PRECIPITATION WITH PHOSPHOTUNGSTIC ACID. R. W. Payne. *J. Soc. Dyers Col.*, 1934, V. 50, P. 320; *Chem. Abs.*, 1935, V. 29, Col. 347. (W)

BLEACHING WOOL WITH HYDROGEN PEROXIDE. P. Huc. *Halle aux Cuirs*, 1934, P. 248–9.

H_2O_2 is preferred to SO_2 despite its higher const., because in wool bleached with SO_2 some of the colorless SO_2 compds. are decompd. in contact with an alk. soln. and the color is regenerated. A recommended bleaching bath contains 1 part Na silicate, 2 parts H_2O_2 (1: 10), and 100 parts H_2O, at 30°, in a wood or Pb tank. Degreased wool is bleached for 2–3 hrs., with stirring every 15 min., then drained, dipped in very dil. H_2SO_4 and washed thoroughly. The used bleach liquor may be analysed for H_2O_2, strengthened and used again. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 1992.) (W)

CALCIUM SOAP: FORMATION OF—AND ITS PREVENTION BY PROTECTIVE COLLOIDS. Karl Lorenz. *Monatschr. Textil-Ind.*, 1934, V. 49, P. 208; *Chem. Abs.*, 1935, V. 29, Col. 1993. (W)

CARBONIZING PROCESS. M. Harris. *Tex. Mfr.*, 1934, V. 49, No. 715, P. 291–2.

As a first step in the teamwork study of wool carbonizing, the effects of sulphuric acid on wool in conditions similar to those in soaking, drying and baking in wool carbonizing have been studied, and an abstract of the results is given. This is work carried out under the direction of a com-

mittee of the American Association of Textile Chemists and Colorists and three papers have appeared in the *Am. Dye. Rptr.*, the first of which is abstracted in this article. (S)

CELLULOSE ACETATE FIBRES: TREATING—IN THE PRESENCE OF OTHER FIBRES. Jean Rolland. *Rev. gen. mat. color.*, 1934, V. 38, P. 431–8.

Cotton can be mercerized in the presence of cellulose acetate by treating the mixed fibres with NaOH of 30° Bé. for 2 min. at 10°, rinsing with water at 10° and neutralizing with 1% H_2SO_4 at 18°. The control tests are dyeing with Blue FF, microscopic test and Hönnel reaction. Illustrative dye baths, particularly of certain vat and diazo colors, are given for treating cellulosic fibres, such as cotton or viscose mixed with cellulose acetate. A method is described for dyeing cellulose acetate with an emulsion contg. aniline, trichloroethylene and solvent naphtha with an acid oxidizing soln. of $NaClO_3$, $CuSO_4$ and HCl. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 1254.) (W)

CHEMICAL ASSISTANTS AND AUXILIARY PRODUCTS. L. G. Lawrie. *Tex. Mfr.*, 1934, V. 60, P. 328–9; *Tex. Col.*, 1934, V. 56, P. 677–9, 708.

A classification and discussion of the properties, uses and general constitution of the more than 1000 products of this type on the market. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 931.) (W)

CHEMICAL THEORY OF DYEING: CONTRIBUTION TO THE. THE AFFINITY OF DEAMINATED WOOL FOR ACID DYES. J. B. Speakman and E. Stott. *J. Soc. Dyers Col.*, 1934, V. 50, P. 341–8; *Chem. Abs.*, 1935, V. 29, Col. 605. (W)

COBALT: NEW USE FOR. C. C. Downie. *Rayon and Mell. Tex. Mo.*, 1935, V. 16, P. 35.

Mordanting of fabrics by electrolysis has been successfully carried out with Co anodes (prepd. by hot-rolling Co onto Ni plates) and Pt cathodes. The electrolyte consisted of a dil. soln. of alum to which was added the coloring matter. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 2361.) (W)

COLLOIDAL ELECTROLYTES IN THE TEXTILE INDUSTRY. A. Chwala. *Oesterr. Chem. Ztg.*, 1935, V. 38, P. 2–4; *Chem. Abs.*, 1935, V. 29, Col. 2750. (W)

COLOR POSSIBILITIES WITH ACETATE RAYON. Richard Hünlich. *Monatschr. Textil-Ind.*, 1934, V. 49, P. 263–4; *Chem. Abs.*, 1935, V. 29, Col. 931, 1988. (W)

DEFATTING AND RINSING OF WOOLEN PIECES. W. Pflumm. *Tiba*, 1934, V. 12, P. 869.

The merits of gardinol (a sulfonated aliphatic alc.) as an adjuvant in the rinsing of woolen pieces are pointed out. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 932.) (W)

DETERIORATION OF VISCOSE DYED WITH VAT DYES. L. Leschellier. *Russa*, 1934, V. 9, P. 657–9, 725–6.

A review bringing out the facts that have been uncontroversially established showing the practical consequences that follow therefrom. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 933.) (W)

DIRECT DIAZO BLACK S: STUDY OF PRODUCTION OF. G. I. Ostrozhinskaya. *Anilin. Prom.*, 1934, V. 4, P. 613–19; *Chem. Abs.*, 1933, V. 27, P. 5727; 1935, V. 29, Col. 2747. (W)

DIRECT DYES: APPLICATION OF—WHICH ARE FAST TO LIGHT. F. Schütz. *Monatschr. Textil-Ind.*, Trade issue III, 1934, V. 49, P. 60–1; *Chem. Abs.*, 1935, V. 29, Col. 1641. (W)

DIRECT DYES: CLASSIFICATION OF—WITH RESPECT TO THE PRODUCTION OF LEVEL DYEINGS ON VISCOSE RAYON. John Boulton and Barbara Reading. *J. Soc. Dyers Col.*, 1934, V. 50, P. 381–9; *Chem. Abs.*, 1935, V. 29, Col. 929. (W)

DYEING AND FINISHING: MODERN DEVELOPMENTS IN TEXTILE CHEMICALS FOR. C. Dunbar. *J. Soc. Dyers Col.*, 1934, V. 50, P. 309–16.

The chemicals include highly sulfonated castor oil, alone and with a solvent such as trichloroethylene, sulfonated naphthalene (represented by Perminal W, Nekal BX, Oranit, etc.). Laventine BL and Oranit BN are similar org. solvents. Sulfonated or sulfated fatty ales. and several stripping agents for fast dyes are mentioned. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 347.) (W)

DYEING COTTON. SUBSTANTIVE DYES AND SALT SENSITIVITY. S. Lenher and J. E. Smith. *Ind. Eng. Chem.*, 1935, V. 27, P. 20–5.

Some essential relationships are pointed out between the particle sizes of four distinct types of substantive (azo) commercial dyes in solution and the mechanism of their absorption on cellulose fibre, with special emphasis on their salt sensitivities. The relationships hold equally well for pure dyestuffs. A few measurements of salt sensitivity will show the probable dyeing affinity, best dyeing temp. with leveling, and ease with which dyes can be applied in combination, and will suggest conditions to prevent bleeding of dyed fabrics. The method can demonstrate an outstanding difference between dyes most suitable for viscose and for cotton. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 930.) (W)

DYEING FIBROUS MATERIALS. VII. DYEING WOOL AND COTTON WITH INDIGO. A. E. Porai-Koshitz. *J. Applied Chem. U. S. S. R.*, 1934, V. 7, P. 359–68; cf. *Chem. Abs.*, 1934, V. 28, Col. 7539.

The object was to det. whether vat dyes are absorbed in the free state or as salts. Wool absorbs Ba from the Ba vat in almost the same amt. as from a Ba salt soln. contg. no indigo, not more than 10% of the amt. equiv. to the indigo adsorbed. Cotton absorbs very small amounts of Ba from a Ba salt soln., but from the Ba vat it takes up slightly more Ba than is equiv. to the indigo absorbed. From these facts it is concluded that wool absorbs free indigo and cotton absorbs the salt. The alky. of the

vat increases in the course of absorption by wool. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 1989.) (W)

DYEING OF CHLORINATED WOOL. S. R. Trotman and H. S. Bell. *J. Soc. Chem. Ind.*, 1935, V. 54, P. 29–3T.

The resistance of some wool fibres to attack by Cl was due not to uneven penetration, but to an inherent property of the fibres themselves. The affinity of chlorinated wool for acid dyes was similar to that of silk in that it could be dyed at low temp. and exhibited its max. affinity for the dye at a temp. below the b. p. While chlorinated wool dyed in the usual manner (by immersing the fabric in the dye bath at 140° F.) gave very uneven dyeing, a similar sample in which the dyeing was begun at room temp. with gradual addn. of the dye soln. and heating of the bath, showed no unevenness. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 2752.) (W)

DYEING OF MIXED FABRICS. J. Holt. *J. Soc. Dyers Col.*, 1934, V. 50, P. 316–20.

The fabrics discussed include: Cotton-wool, cotton-viscose rayon, hat ribbons, linings and cellulose-acetate rayon-silk or wool. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 348.) (W)

DYEING OF MIXED TEXTILES OF SILK AND WOOL. R. Hünlich. *Monatsh. Seide Kunstseide*, 1934, V. 39, P. 418–21.

H. gives directions for the preliminary treatment of wool-silk, the use of Na_2O_2 bleach and the Blankit I-bleach, and the dyeing of such mixed textiles. A large no. of dyes are listed which can be used to dye wool-silk or wool-silk goods yellow, orange, brown, red, violet, blue, green and black. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 348.) (W)

DYEING OF RAYON YARN. Theo. Schickl. *Z. ges. Textil-Ind.*, 1934, V. 49, P. 633–4; *Chem. Abs.*, 1935, V. 29, Col. 1253. (W)

DYEING OF STAPLE FIBRES AND MIXED YARNS WITH INDANTHRENE DYES. Karl Linsenmeier. *Mell. Textilber.*, 1934, V. 15, P. 516–17; *Chem. Abs.*, 1935, V. 29, Col. 1989. (W)

IV. RESEARCH METHODS AND APPARATUS

COLOR BLINDNESS. Walter Garner. *Tex. Mfr.*, March 1935, P. 116–17.

The article is an outline of color facts bearing upon color blindness or partial defects, and a review of color theories and tests. Some experimental work is described. (S)

COTTON BLEACHING MICROSCOPE TEST. Anon. *Tex. Mfr.*, Jan. 1935, P. 30.

The study is a very brief one and mentions the fact that Victoria Blue B will dye the cuticle and central channel contents of the wool fibre and possibly the inner wall surface without dyeing the cellulose of the secondary deposit. Different depths of dyeing are said to be obtained according to different degrees of bleaching, for example. This method has

been used with satisfaction for producing stains on outlines of cross-sections of cotton fibres for other studies, such as degree of maturity, etc. in the M. I. T. textile microscopy laboratory. The item is abstracted by *Tex. Mfr.* from the *Tex. Col.* (S)

DIFFUSE ILLUMINATION COLOR COMPARATOR AND REFLECTOR. Anon. *Instruments,* 1935, V. 8, No. 3, P. 82.

An instrument designed originally by Priest, Lange and Judd in the Colorimetry Section of the Bureau of Standards. The device by applying suitable filters may be used as a rather efficient device for tri-chromatic color analysis. It can also be extensively used for reflection measurements and for comparison of colored objects. Diffuse illumination of the specimens is obtained by means of an integrating sphere with four 6-volt electric light bulbs of the shielded filament type as a source of illumination. The measurements are made by means of the ordinary Martens Polarization Photometer. (S)

DYED COTTON: HOW TO TEST—QUICKLY FOR ITS COLOR FASTNESS. Karl Volz. *Z. ges. Textil-Ind.,* 1935, V. 38, P. 14–16; *Chem. Abs.,* 1935, V. 29, Col. 1641. (W)

FLUORESCENCE ANALYSIS: PROGRESS IN. (German.) Dr. Karl Träger. *Die Kunstseide,* April 1935, P. 139–41.

A brief description of several newer types of ultraviolet lamps for use in fluorescent analysis together with a very brief review of certain recent work done in fluorescent studies, notably the rayon material. Nothing of particular importance from a processing standpoint is outlined. (S)

"FULSCOPE" TIME SCHEDULE CONTROLLER. Anon. *Instruments,* April 1935, P. 106.

Photograph and description to outline the method of operation and construction of an instrument for control of temperature, pressure, flow, and liquid level (or combinations of these) according to a predetermined time schedule. (S)

IRON IN TECHNICAL NIGROSINE: DETERMINATION OF. E. S. Khotinskii and V. I. Bogomolov. *Ukrain, Khem. Zhur.,* 1933, V. 8, P. 393–7.

The nigrosine is heated cautiously in a tube in a stream of moist O_2, and Fe is detd. in the ash by the usual methods. (Copied complete from *Chem. Abs.,* 1935, V. 29, Col. 1990.) (W)

JUTE: MOISTURE ABSORPTION OF. J. H. Ingmanson and G. N. Vacca. *J. Ind. Eng. Chem.,* 1934, V. 26, No. 12, P. 1274–75.

Moisture absorption by textile fibres is generally assumed to be prevented or at least greatly reduced by treating with bituminous materials. Although bituminous treating materials absorb little moisture, they are permeable to moisture. It might be expected that, when these materials are coated on textile fibres, the rate at which moisture is taken up by the fibre would be greatly reduced but the total quantity taken up would be the same without regard to impregnation. The theory has been tested by determining the water absorption of untreated and treated jute over

a wide range of humidity conditions. The usual treatment of jute with a mixture of asphalt and wax or of anthracene oil and coal-tar pitch has practically no effect on equilibrium moisture content of the jute. Both treated jute and untreated jute show the hysteresis effect commonly observed in other fibrous materials; *i.e.*, that after exposure to high humidity they show higher equilibrium moisture content at reduced humidities than they did previous to high humidity exposure. Cutting jute fibres into short lengths does not increase equilibrium moisture content. Treatment of jute with an asphalt wax compound decreases rate of approach to equilibrium moisture content. (S)

MERCERIZATION: DETERMINATION OF THE DEGREE OF. L. P. Michel. *Tiba*, 1934, V. 12, P. 495–9, 593–7, 679–83, 745–9.

A review and discussion of the various methods which have been used for detg. the degree of mercerization: microscopical examn. for estg. degree of swelling, increase in H_2O absorption, increase in affinity toward direct dyes and I absorption. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 933.) (W)

MERCERIZING PROCESS UNDER THE MICROSCOPE. H. Reumuth. *Z. ges. Textil-Ind.*, 1935, V. 38, P. 21–4; *Chem. Abs.*, 1935, V. 29, Col. 1993. (W)

MERCERIZATION: DETERMINATION OF THE DEGREE OF. V. G. Abozin. *Trans. Leningrad Chem.-Tech. Inst.*, 1934, V. 1, P. 215–25.

A method giving as accurate results as the Schwalbe and Sieber (*Chem. Abs.*, V. 14, P. 2084), though slightly higher, but much simpler and quicker, is described, in which the ratio of the copper nos. is the criterion of mercerization. Soak 2-g. samples of mercerized and unmercerized material in 0.5% H_2SO_4 and wring out under pressure so that exactly 100% by wt. of soln. remains absorbed. Heat the samples in a drying oven at 98° for one hr. and det. the copper nos. by the method of Braidy. Longer drying increases both copper nos. but decreases the ratio. (Copied complete from *Chem. Abs.*, 1935, V. 29, Col. 2754.) (W)

MICRO-PROJECTOR. Anon. *Instruments*, 1935, V. 8, No. 3, P. 83.

A simple and light-weight micro-projecting unit which will take any standard microscope is described. The source of illumination is an automatically adjusted carbon arc light with suitable cooling cell and optical bench arranged to take a microscope for vertical or horizontal projection. (S)

PROJECTOR: A NEW TEXTILE. Anon. *Am. Silk and Rayon J.*, May 1935, P. 48.

A very brief description of a new textile projector which has been tested at the M. I. T. textile laboratory with satisfaction is outlined. The instrument is capable of giving projected images of fabric surfaces as well as silhouettes and also is useful for the study of yarn. By use of either a photographic plate holder or bromide paper photographs of acceptable quality are very quickly and easily prepared as a matter of record of conditions as found in the fabric. This should prove a very satisfactory instrument for the study of many fabrics and yarns from the standpoint of structure and imperfections. (S)

RAYON: TESTING OF. Jacques Klinger. *Kunstseide,* 1934, V. 16, P. 388–91.

A review and discussion of microscopic methods for studying the cause of various effects in rayon filaments. A no. of illustrative photomicrographs are given. (Copied complete from *Chem. Abs.,* 1935, V. 29, Col. 2754.) (W)

RAYON: TESTING OF. A. Salmony-Karsten. *Kunstseide,* 1935, V. 17, P. 3–5.

A description and discussion, with illustrative diagram and photograph, of a new comparison microscope particularly suitable for use in works labs. (Copied complete from *Chem. Abs.,* 1935, V. 29, Col. 2754.) (W)

RAYON FILAMENTS: DETERMINATION OF COUNT REGULARITY OF. W. Weltzien and W. Rhein. *Mtsh. S. u. Ksts.,* 1934, p. 479.

The authors describe a method of determining the variations of count in rayon filaments which consists in winding the rayon on to a swift, cutting off a definite length, and weighing the separate threads on a micro-balance. The fluctuations are shown graphically and typical records are reproduced. (Abstracted by *Rayon and Mell. Tex. Mo.*) (S)

STITCH LENGTH VARIATION: ANALYSIS OF. J. B. Lancashire. *Tex. Mfr.,* January 1935, P. 11.

The article describes a quantitative method of estimating the quality of knitted fabric and measuring the factors responsible for the irregularity of them encountered. Several tables and formulae are noted which may be used by the analyst. (S)

SYNCHRONIZING: A NEW METHOD OF AUTOMATIC. W. A. Holland. *Instruments,* April 1935, P. 88.

The system outlined in diagram and described by the author is said to be a decided improvement upon earlier methods for accomplishing results. The complete system consists of a network which produces a D.C. voltage that reverses at the instant that the closing indication should be given; a thermionic tube amplifier controlled by this voltage; and a group of interlocking and auxiliary relays. The increasing use of automatic synchronization of range machinery for finishing and other operations in textile mills makes any positive contribution in this field of interest to the textile man and to the textile research development worker. (S)

WOOL FIBRES: DETERMINATION OF THE DEGREE OF CARBONIZATION OF. D. N. Griboedov and V. G. Abozin. *Trans. Leningrad Chem.-Tech. Inst.,* 1934, V. 1, P. 173–82.

To the piece of wool to be partially carbonized to test for plant admixtures are fastened a number of small pieces of cotton cloth which then go through the whole carbonization process. The copper nos. of the cotton pieces as detd. by the Braidy method are a measure of the degree of carbonization of the woolen cloth, and of the uniformity of treatment of different parts of the material. (Copied complete from *Chem. Abs.,* 1935, V. 29, Col. 2751.) (W)